Appendix A
The Regional Transportation Analysis Zone System

Introduction

The Regional Model's study area includes Los Angeles County, Orange County, Ventura County, Riverside County, San Bernardino County and Imperial County. Recent additions to the modeling area included the desert portions of Riverside and San Bernardino Counties and Imperial County.

The redefinition of the Regional Transportation Analysis Zone (TAZ) System is an important aspect of SCAG's model improvement program. The transportation analysis zones are essential components in the transportation model. The TAZs provide the spatial unit (or geographical area) within which travel behavior and traffic generation are estimated. The zone size varies depending on the density and nature of the urban development. The Regional Model includes 4109 internal zones. (see Table A-1 for a description of the TAZ system). In addition to the internal zones there are 31 port zones, 12 airport zones, and 40 cordon zones. See Table A-1 for the TAZ summary.

Methodology

The TAZ system is consistent with both the 2000 census geography and existing subregional TAZs. Within the urban areas the zonal detail will be similar to the census tract. Commercial / industrial areas within the urban area will require further subdividing and large census tracts in developing areas will be split to account for future growth.

The following provides a description of the principles that guided the development of the Regional zone system. The principles were developed using standard modeling practice:

Consistency with Existing Subregional Models - To maintain the zonal hierarchy, the Regional Model TAZs were based directly on existing subregional model TAZs. Subregional TAZs were available for most of the Regional Modeling area. Where subregional zones existed, the Regional TAZs are either a single subregional TAZ or an aggregation of several subregional TAZs.

Consistency with 2000 Census Tract Boundaries - The subregional models' TAZ systems are consistent with 2000 Census geography. All Subregional TAZs are either entire census tracts or are wholly contained within a census tract. Where subregional TAZs did not exist, the Regional TAZs were created respecting census tract boundaries.

Consistency with Census Block Boundaries - The finest level of geography in both the 1990 Census and Subregional Models is the Census Block. To ease data collection and creation, zonal boundaries generally do not break Census Blocks. There are several subregional TAZs in developing rural areas where the TAZs boundaries do split census blocks.

Complement the Transportation System - A critical step in developing the TAZ system is defining the level of roadway facilities for which accurate forecasts are desired. To ensure accurate distribution and traffic assignments, existing and future freeways and principal arterials are generally represented as Regional TAZ boundaries. This effort was balanced against honoring the other zonal creation criteria.

Homogeneous Land Use - Land use maps and general plan maps were used to identify existing and future land use. Ideally, it is best to limit the number of different land uses contained within a zone. However, given the geographic size of the Regional TAZs and mixed use development patterns within the urban area, it was often difficult to create zones with uniform land uses.

Similar Population/Employment Size - Zones were developed to represent similar levels of future development (population and employment). This parameter was not strictly enforced given the sparse development of some areas, the intensity of non-residential land uses within urban areas, and consideration for special generators (example - universities and airports).

Other Considerations - Natural and man made boundaries are also considered in the definition of the zone system. Political jurisdictions, railroad lines, rivers, mountain ranges and other topographical barriers were considered in the development of both the subregional and Regional TAZs.

GIS coverages of subregional TAZ systems were gathered for all the existing subregional models. Draft zonal maps were developed by applying the above principles. The Regional zonal boundaries were manually drafted onto census tract and block maps by comparing overlays of the highway system, land uses, and existing subregional TAZs. Using these highlighted maps, a technician entered the boundaries into a digital file using ARC-INFO. Several editing steps were undertaken to ensure that all subregional TAZs and census blocks were assigned to the proper Regional TAZ. Once a clean zonal boundary file was created, final zone numbers were assigned to the draft TAZ system.

Table A-1

SUMMARY OF TAZ STATISTICS

Modeling Area	Census Tract	RSA	CSA	Total TAZ	TAZ (Internal)		TAZ (Codon Stations)		TAZ (Airport)		TAZ (Port Zone)	
					#	Seq	#	Seq	#	Seq	#	Seq
Imperial County	29	1	15	118	110	4000-4109	7	4136-4142	1	4155		
Los Angeles County	2,067	22	155	2,285	2,243	211-2453	7	4114-4120	4	4151-4154	31	4162-4192
Orange County	577	10	43	668	666	2454-3119	1	4149	1	4156		
Riverside County	400	10	38	487	478	3120-3597	7	4135, 4143-4148	2	4157-4158		
San Bernardino County	244	7	34	419	402	3598-3999	14	4121-4134	3	4159-4161		
Ventura County	157	6	17	215	210	1-210	4	4110-4113	1	4150		
Total	**3,474**	**56**	**302**	**4,192**	**4,109**		**40**		**12**		**31**	

Appendix B
Regional Highway Network Coding Conventions

SCAG – Functional Class Coding *<<Facility Type>>*

1 - Freeways
- 10 – Freeway

2 - HOV
- 20 – HOV 2
- 21 – HOV 3+
- 22 – HOV – HOV Connector
- 23 – HOV Slip ramp OUT (Slip ramp from HOV to MF)
- 24 – HOV Slip ramp IN (Slip Ramp from MF to HOV)
- 25 – HOV-MF dummy links

3 - Expressway/Parkway
- 30 – Undivided
- 31 – Divided, Interrupted
- 32 – Divided, Uninterrupted

4 - Principal Arterial
- 40 – Undivided
- 41 – Divided
- 42 – Continuous Left Turn

5 - Minor Arterial
- 50 – Undivided
- 51 – Divided
- 52 – Continuous Left Turn

6 - Major Collector
- 60 – Undivided
- 61 – Divided
- 62 – Continuous Left Turn

7 - Minor Collector
- 70 – Undivided
- 71 – Divided
- 72 – Continuous Left Turn

8 - Ramps
- 80 – Freeway to Freeway Connector
- 81 – Freeway to arterial
- 82 – Arterial to freeway
- 83 – Ramp Distributor

84 – Ramp from Arterial to HOV
85 – Ramp from HOV to Arterial
86 – Collector distributor
89 – Truck only

9 - Trucks
90 – Truck only

100 - Centroid connector

Flag fields:
Type1_Thru Lane – Through Freeway Lanes
Type2_AUX_ Lane – Auxiliary Lane of Capacity Significance
Type3_Other Fwy Lane – Other Freeway Lane

Truck Climbing Lanes flag:
0 – None
1 – 1 Truck Climbing Lane
2 – 2 Truck Climbing Lane
3 – 3 + Truck Climbing Lane

Toll flag:
0 – None
1 – Toll road
2 – HOT Road

Signals flag:
0 – None
1 – Signal and progression optimized streets
2 – Divided and signal optimized
3 – Continuous left-turn Lanes

HOV Operation flag:
0 – Standard HOV
1 – HOV AM Peak Only
2 – HOV PM Peak Only
3 – HOV AM & PM Peak Only

Truck Prohibition flag:
0 – Truck Not Prohibited
1 – Trucks Prohibited

Appendix C
Specification of Trip Production Models

Tables C-1 through C-10 in this Appendix present the cross-classification trip production models employed in the Year 2003 SCAG Regional Model. Listed below are the trip production models presented in this Appendix, by trip purpose:

Table C-1	Home-Based Work – Direct Trip Productions
Table C-2	Home-Based Work – Strategic Trip Productions
Table C-3	Home-Based Elementary-High School Trip Productions
Table C-4	Home-Based College/University Trip Productions
Table C-5	Home-Based Shopping Trip Productions
Table C-6	Home-Based Social-Recreation Trip Productions
Table C-7	Home-Based Other Trip Productions
Table C-8	Home-Based Serving Passengers Trip Productions
Table C-9	Other-Based Other Trip Productions
Table C-10	Work-Based Other Trip Productions

Table C-1

HOME-BASED WORK-DIRECT TRIP PRODUCTION MODEL

Number of Workers in Household	Household Size	Age of Head of Household			
		18-24	25-44	45-65	66+
1	1	1.416	1.431	1.367	1.045
1	2	1.543	1.560	1.490	1.139
1	3	1.287	1.301	1.242	0.950
1	4+	1.260	1.274	1.217	0.930
2	1				
2	2	2.619	2.631	2.576	2.267
2	3	2.402	2.413	2.363	2.079
2	4+	2.385	2.397	2.347	2.065
3+	1				
3+	2				
3+	3	3.866	3.866	3.865	3.571
3+	4+	4.465	4.259	4.288	3.629

Table C-2

HOME-BASED WORK-STRATEGIC TRIP PRODUCTION MODEL

Number of Workers in Household	Household Size	Age of Head of Household			
		18-24	25-44	45-65	> 65
1	1	0.261	0.245	0.310	0.632
1	2	0.134	0.116	0.187	0.538
1	3	0.390	0.376	0.434	0.727
1	4+	0.416	0.402	0.460	0.747
2	1				
2	2	0.683	0.670	0.725	0.988
2	3	0.900	0.888	0.939	1.176
2	4+	0.916	0.905	0.955	1.191
3+	1				
3+	2				
3+	3	1.008	1.008	1.009	1.257
3+	4+	1.171	1.117	1.125	1.282

Table C-3

HOME-BASED ELEMENTARY/HIGH SCHOOL TRIP PRODUCTION MODEL

Number of Household Members with Age 5-17	Trip Rates
0	0.0379349
1	1.2521514
2	2.4662221
3	4.0275804

Table C-4

HOME-BASED COLLEG/UNIVERSITY TRIP PRODUCTION MODEL

Household Income	Number of Household Members with Age 18-24		
	0	1	2
<$25K	0.0761822	0.357	0.686
$25-50K	0.0683866	0.266	0.469
$50-100K	0.0562337	0.246	0.487
>$100K	0.0316451	0.284	0.782

Table C-5

HOME-BASED SHOPPING TRIP PRODUCTION MODEL

Household Size	Household Vehicle	Household Income			
		<$25K	$25-50K	$50-100K	>$100K
1	0	0.340	0.306	0.299	0.295
1	1	0.560	0.504	0.491	0.484
1	2	0.588	0.529	0.517	0.509
1	3+	0.599	0.539	0.526	0.518
2	0	0.664	0.616	0.604	0.593
2	1	0.888	0.824	0.809	0.804
2	2	0.931	0.863	0.847	0.842
2	3+	0.940	0.871	0.855	0.850
3	0	0.782	0.735	0.717	0.699
3	1	0.996	0.936	0.912	0.906
3	2	1.042	0.980	0.955	0.948
3	3+	1.058	0.994	0.969	0.962
4+	0	0.960	0.911	0.894	0.890
4+	1	1.164	1.106	1.085	1.080
4+	2	1.214	1.153	1.131	1.125
4+	3+	1.230	1.168	1.145	1.140

Table C-6

HOME-BASED SOCIAL-RECREATION TRIP PRODUCTION MODEL

Household Size	Household Vehicle	Household Income			
		<$25K	$25-50K	$50-100K	>$100K
1	0	0.202	0.224	0.232	0.241
1	1	0.379	0.420	0.435	0.452
1	2	0.442	0.490	0.508	0.528
1	3+	0.533	0.590	0.611	0.635
2	0	0.452	0.463	0.466	0.461
2	1	0.649	0.665	0.668	0.686
2	2	0.717	0.734	0.738	0.759
2	3+	0.819	0.839	0.843	0.866
3	0	0.606	0.611	0.599	0.602
3	1	0.815	0.821	0.805	0.814
3	2	0.897	0.904	0.886	0.896
3	3+	1.007	1.015	0.995	1.006
4+	0	0.863	0.866	0.855	0.868
4+	1	1.070	1.075	1.060	1.077
4+	2	1.152	1.157	1.141	1.159
4+	3+	1.261	1.266	1.249	1.269

Table C-7

HOME-BASED OTHER TRIP PRODUCTION MODEL

Household Size	Household Vehicle	Household Income			
		<$25K	$25-50K	$50-100K	>$100K
1	0	0.584	0.584	0.584	0.584
1	1	0.584	0.584	0.584	0.584
1	2	0.584	0.584	0.584	0.584
1	3+	0.584	0.584	0.584	0.584
2	0	1.037	1.037	1.037	1.037
2	1	1.037	1.037	1.037	1.037
2	2	1.037	1.037	1.037	1.037
2	3+	1.037	1.037	1.037	1.037
3	0	1.397	1.397	1.397	1.397
3	1	1.397	1.397	1.397	1.397
3	2	1.397	1.397	1.397	1.397
3	3+	1.397	1.397	1.397	1.397
4+	0	2.057	2.057	2.057	2.057
4+	1	2.057	2.057	2.057	2.057
4+	2	2.057	2.057	2.057	2.057
4+	3+	2.057	2.057	2.057	2.057

Table C-8

HOME-BASED SERVING PASSENGERS TRIP PRODUCTION MODEL

Household Size	Household Vehicle	Household Income			
		<$25K	$25-50K	$50-100K	>$100K
1	0	0.059	0.033	0.009	0.002
1	1	0.501	0.279	0.080	0.018
1	2	0.260	0.144	0.041	0.009
1	3+	0.158	0.088	0.025	0.006
2	0	0.112	0.079	0.058	0.052
2	1	0.784	0.558	0.407	0.368
2	2	0.714	0.508	0.371	0.335
2	3+	0.191	0.136	0.099	0.090
3	0	0.850	0.758	0.691	0.688
3	1	1.416	1.263	1.151	1.146
3	2	1.333	1.189	1.083	1.079
3	3+	0.993	0.885	0.807	0.803
4+	0	2.489	2.387	2.313	2.296
4+	1	3.009	2.886	2.796	2.776
4+	2	2.930	2.810	2.722	2.703
4+	3+	2.629	2.522	2.443	2.425

Table C-9

OTHER-BASED OTHER TRIP PRODUCTION MODEL

Household Size	Household Vehicle	Household Income			
		<$25K	$25-50K	$50-100K	>$100K
1	0	0.415	0.453	0.437	0.444
1	1	1.297	1.414	1.363	1.387
1	2	1.355	1.478	1.425	1.449
1	3+	1.399	1.525	1.470	1.495
2	0	0.989	1.049	1.030	1.052
2	1	1.870	1.984	1.948	1.989
2	2	1.913	2.029	1.992	2.035
2	3+	1.958	2.078	2.039	2.083
3	0	1.422	1.499	1.461	1.481
3	1	2.317	2.443	2.380	2.413
3	2	2.367	2.495	2.431	2.465
3	3+	2.412	2.543	2.478	2.512
4+	0	2.586	2.690	2.656	2.687
4+	1	3.482	3.622	3.576	3.617
4+	2	3.513	3.654	3.607	3.649
4+	3+	3.553	3.696	3.649	3.691

Table C-10

WORK-BASED OTHER TRIP PRODUCTION MODEL

Number of Workers in Household	Household Size	Household Income			
		<$25K	$25-50K	$50-100K	>$100K
1	1	0.381	0.715	0.919	1.316
1	2	0.354	0.665	0.855	1.224
1	3	0.241	0.453	0.582	0.834
1	4+	0.203	0.381	0.489	0.701
2	1				
2	2	0.732	1.072	1.252	1.577
2	3	0.607	0.889	1.038	1.308
2	4+	0.574	0.840	0.981	1.237
3+	1				
3+	2				
3+	3	0.672	0.999	1.189	1.541
3+	4+	0.629	0.934	1.112	1.442

Appendix D
Auto Operating Costs

Auto operating cost (in cents/mile) is a key parameter in the calculation of the marginal utility cost functions used in mode choice. In the current mode split model, auto operating cost is defined as an out-of-pocket expense consisting of fuel (primarily gasoline) cost and "other" costs. Other costs include repairs, maintenance, tires, and accessories.

The table below summarizes the Year 2003 auto operation cost calculation and gives the values of the intermediate parameters. The calculation of the fuel cost per mile requires the composite fuel economy for the fleet and an average motor fuel price. Historical U.S. fuel efficiency data from 1980 to 2006 collected and compiled by the U.S. DOT National Highway Safety Administration was used by SCAG staff to calculate the average miles per gallon. The average price of a gallon of motor vehicle fuel was calculated as the sum of the prices of each grade sold, weighted by its fractional share of the market. The average fuel cost, including all taxes, for 2003 was 189.5 cents per gallon, which equates to 130 cents per gallon in 1989 constant dollars. Thus the fuel costs for 2003 in terms of cents/mile can be derived from dividing fuel costs (130 cents/gallon) by average fuel efficiency (22.3 miles/gallon). As a result, the 5.83 cents-per-mile fuel costs (in 1989 cents) was estimated and used for the 2003 model validation.

Table D-1

AUTO OPERATING COST CALCULATION

Description	Value	Based on
2003 On-road miles/gallon	22.30	MPG for SCAG Region
Avg. Year 2003 cents/gallon	189.50	Price & volume sold by fuel grade
Converted to 1989_cents*/gallon	130.00	
Fuel Cost (1989_cents/mile)	5.83	Gallon/mile * cents/gallon
Other Costs (1989_cents/mile)	4.80	Repairs, maint., tires, accessories
Total Cost/Mile (1989 cents)	10.63	
Total Cost/Mile (1999 cents)	**13.76**	

Note: *1989/2003 CPI = 128.3/187 = 0.686

The Year 2003 Model Validation uses the value of 4.8 cents per mile (in 1989 dollars) for "other costs" as calculated by SCAG's Economic Analysis/Forecasting Section using data compiled by the General Services Administration and the National/Southern California AAA. Adding 4.8 cents per mile for "other" costs to the fuel costs per mile (5.83 cents/mile), yields a total auto operating cost of 10.63 cents per mile for 2003 in 1989 dollars or 13.76 cents per mile in 1999 dollars.

Acknowledgement

SCAG Management:

Mark Pisano, Executive Director
Jim Gosnell, Deputy Executive Director
Wayne Moore, Chief Financial Officer
Hasan Ikhrata, Director of Planning and Policy
Sylvia Patsaouras, Director of Government and Public Affairs
Keith Killough, Director of Information Services
Joann Africa, Director of Legal Services (acting)
Basil Panas, Manager of Accounting
Lynn Harris, Manager of Community Development
Jacqueline Bobo, Manager of Budgets and Grants
Jacob Lieb, Manager of Environmental Planning (acting)
Don Rhodes, Manager of Legislative Affairs
Huasha Liu, Manager of Data and Monitoring
Leyton Morgan, Manager of Contracts
Rich Macias, Manager of Transportation Planning and Programming
Bev Perry, Manager of Members Relations
Catherine Chavez, Manager of Information Technology
Deng Bang Lee, Manager of Modeling
Debbie Dillon, Manager of Human Resources
Cheryl Collier, Communication Supervisor
Bonnie Verdin, Business Operation Supervisor
Richard Howard, Internal Auditor

SCAG Modeling Staff

Deng Bang Lee
Guoxiong Huang
Teresa Wang
Mike Ainsworth
Hsi-Hwa Hu
Julie Zhu
Sreedharan Nambisan
KiHong Kim

Other SCAG Staff:

Community Development Department (Socio-Economic Data)

Frank Wen
Ying Zhou
Simon Choi

Data and Monitoring Department (GIS Support)

Demitris Poulakidas
Ping Wang

Environmental Planning Department (Emissions Model & Conformity)

Jonathan Nadler
Arnie Sherwood

Business Operations (Report Formatting and Production)

Wilma Fu

Modeling Task Force, Participating Agencies:

California State Department of Transportation – Caltrans Districts 7, 8, 11, & 12
California Air Resources Board
South Coast Air Quality Management District
The Ventura Air Pollution Control District
The Mojave Desert Air Quality Management District
The Imperial County Air Pollution Control District
The Antelope Valley Air Pollution Control District
The Los Angeles County Metropolitan Transportation Authority
Orange County Transportation Commission
Riverside County Transportation Commission
San Bernardino Associated Governments
Ventura County Transportation Commission
Imperial Valley Associated of Governments
Federal Highway Administration.
The Federal Transit Administration
The Environmental Protection Agency

Consultant Team:

NuStats – Year 2001 Travel Survey
Cambridge Systematics – Model development & model calibration
Caliper Corp. – Software conversion & model validation **
Dowling Associates – Model's speed function
Vanasse Hangen Brustlin – Peer reviews
Hong Kim – Survey interpretation and model calibration
** Special thanks to Jim Lam (Caliper) for all of your long hours and extra efforts

Reviewed by:

Frank Spielberg **-** Vanasse Hangen Brustlin

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